Maricopa County
Air Quality Department

NON-TITLE V
TECHNICAL SUPPORT DOCUMENT

PERMIT NUMBER:	040136	**App. ID(s):**	411739
BUSINESS NAME:	Hickman's Egg Ranch	**Revision(s):**	2.0.3.0
SOURCE TYPE:	Poultry Egg Production	**Revision Type(s):**	Minor Modification
PERMIT ENGINEER:	Sara Seuberling	**Date Prepared:**	05/11/2016

BACT: No **MACT:** Yes **NSPS:** Yes **SYNTH MINOR:** No **AIRS:** No

DUST PLAN REQUIRED: No **DUST PLAN RECEIVED:** No

O&M PLAN REQUIRED: Yes **O&M PLAN RECEIVED:** No

PORTABLE SOURCE: No **SITE VISIT: 11/20/2015**

PROCESS DESCRIPTION:

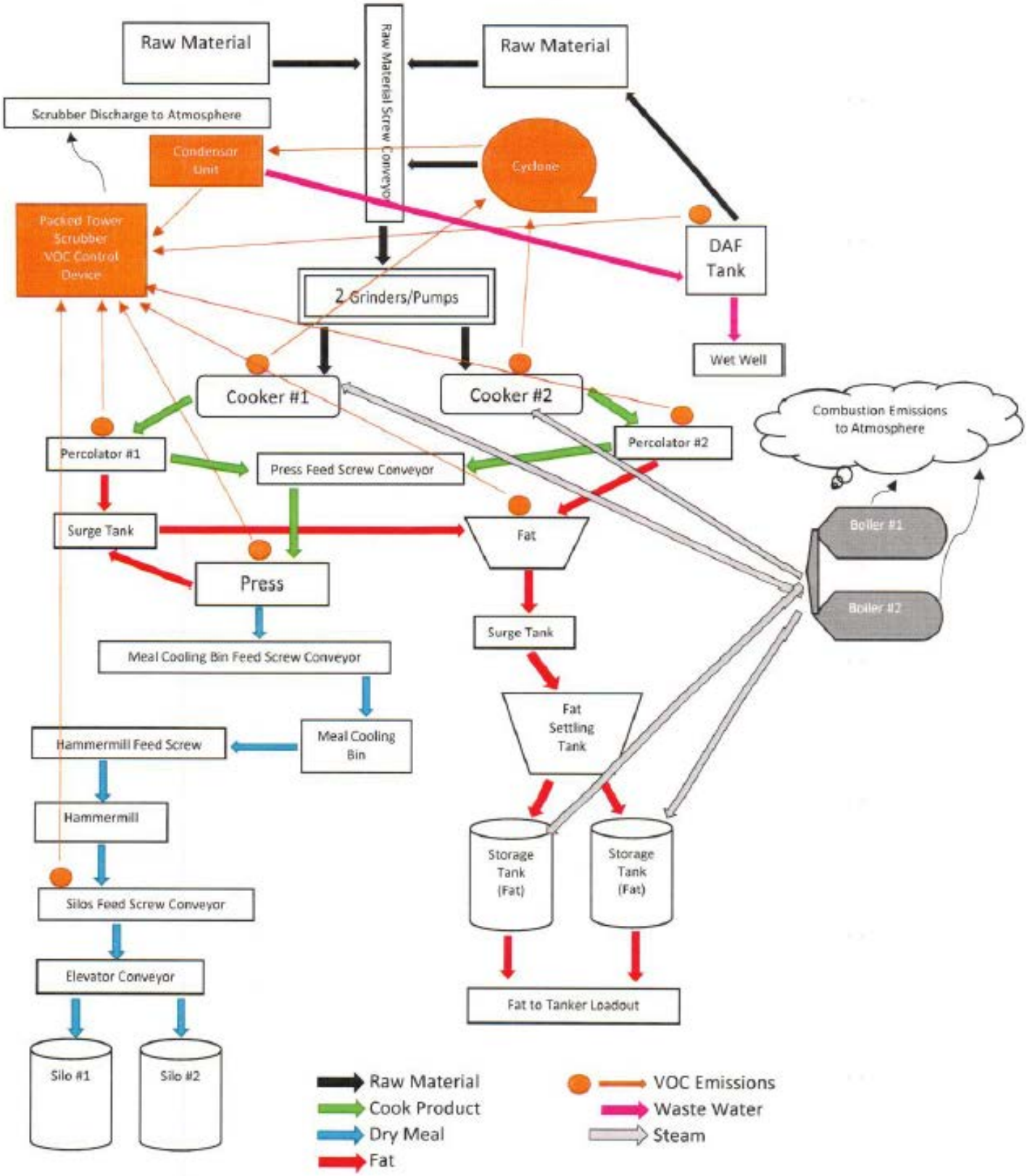
This facility houses chickens for the production of eggs for human consumption. Each barn is equipped with an emergency generator to power fans during an electrical outage. These generators emit products of combustion while in operation, such as carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM), volatile organic compounds (VOC), and sulfur oxides (SOx). A propane-fuled rotary manure dryer, pellet dryer, boilers, pullet house heaters, and pressure washer also emit products of combustion during operation. A new protein plant, described below, will release VOC and PM. Non-resale gasoline is stored and dispensed on-site, which emits VOC. A new parts washer that uses solvent to clean various metal parts in the truck shop is also expected to release VOC emissions. A crematory was formerly used for the disposal of chicken carcasses but has since been dismantled.

In the egg processing plant, eggs are conveyed from henhouses, bathed in an acid wash solution, evaluated electronically for defects, mechanically sorted, and packaged by size for resale. A portion of the eggs are boiled, deshelled, and packaged. In the liquid egg operation, the liquid portion of the egg is separated from the shell, pasteurized, and packaged in plastic totes. Safety data sheets indicate that one sanitizer, Sano Quat 4100, contains VOC but none of the materials used in the egg plants contain hazardous air pollutants (HAPs).

In the protein plant, chicken carcasses are ground and fed to one of two cookers, which are heated by two 11.544 MMBtu/hr boilers. Cooked material is sent to a percolator to separate solids (protein) from liquids (fat and water). Cooked solids are pressed, cooled, milled, then conveyed to silos for shipment as animal feed. Fat from the percolator and press are pumped to surge tanks, followed by a settling tank, then stored onsite in heated tanks. Cooker exhaust is sent to a cyclone to collect solids that reenter the process as raw material. Vapors leaving the cyclone are condensed and sent to a dissolved air flotation (DAF) tank to clarify wastewater from the plant by removing suspended matter such as fats and solids. Exhaust gases from the plant are controlled by a packed bed scrubber using sodium hydroxide (NaOH). Some compounds are absorbed into the scrubber liquid while others are converted to water-soluble salts, such as sodium sulfide (Na_2S). Contaminants are removed from the scrubber as an overflow or blowdown stream. Emissions from the protein plant include VOC, PM, H_2S and products of combustion (boilers).

PM is produced from an on-site feed mill, protein plant, manure drying, composting operations, feed delivery, unpaved roads, and unpaved parking lots. However, Eric Massey, director of the Arizona Department of Environmental Quality (ADEQ), agreed that all of these operations are considered agricultural practices and are therefore subject to Best Management Practices (BMPs) under A.R.S. 49-457 rather than County Rules 310 and 311. Per A.R.S. 49-457.P.5(a) and 49-457.P.6(b), a commercial poultry facility within a portion of Area A in a county with a population of two million or more persons is a regulated agricultural activity. This Arlington facilty is a commercial poultry facility located in Area A and Maricopa County has over two million people so it is it must comply with an agricultural general permit per A.R.S 49-457.G. BMPs are regulated by ADEQ rather than Maricopa County so conditions regarding those operations are excluded from the permit.

Protein Plant Flow Diagram



PERMIT HISTORY:

Date Received	Revision Number	Description
10/15/2004	0.0.0.0	Submitted application for new permit to operate a crematory and emergency generators at the egg farm.
03/09/2011	0.0.1.0	Minor modification requested to add emergency generators G-1 through G-19 and gasoline storage to the equipment list.
03/10/2011	1.0.0.0	Submitted permit renewal application.
10/11/2011	0.0.2.0	Minor modification requested to add a feed mill to the facility
12/07/2011	1.0.1.0	Minor modification requested to install a grain receiving and storage operation and emergency generator FM-1 at the facility.
05/20/2013	1.0.2.0	Minor modification requested to add emergency generators G-20, G-21, and G-22 to the equipment list.
06/24/14	2.0.0.0	Submitted permit renewal application.
06/24/14	2.0.1.0	Minor modification requested to add emergency generators G-23, G-24, and G-25 to the equipment list.
07/20/2015	2.0.2.0	Minor modification requested to add a 15 MMBtu/hr propane-fueled rotary dryer for manure processing along with a 15,000 propane tank. The application also requested that requirements for the feed mill be removed from the permit since it is regulated under BMPs regulated by ADEQ. The Permittee also requested the equipment list to be updated with a replacement emergency generator.
02/03/2016	2.0.3.0	Minor modification requested to install three diesel emergency generators (G-45, G-46, G-47), relocate two emergency generators (G-5 and G-6) and install two 11.544 MMBtu/hr boilers at a new protein plant. A separate notice was submitted via e-mail 12/10/2015 listing propane-fueled equipment and an above-ground gasoline tank. Another notice was submitted via e-mail 4/02/2016 listing parts washers for a new truck shop and fat storage tanks for the protein plant. A final e-mail was received from the source 4/07/2016 to include a 741,287 BTU/hr propane-heated pressure washer in the minor modification.

PURPOSE FOR APPLICATION:

Minor modification to install equipment related to a protein plant and add fuel burning equipment to the permit and equipment list. The following equipment is being incorporated into this minor modification

- Two new 464 hp Cummins emergency engines (G-45, G-47) for the henhouses
- One used 1,482 hp Caterpillar emergency engine (G-46) for the protein plant
- One 80 gallon parts washer
- One 20 gallon parts washer
- One 5,000 gallon gasoline tank
- Two 11.544 MMBtu/hr propane-fueled boilers for the protein plant
- One packed bed scrubber for the protein plant
- One 741,287 Btu/hr propane-heated pressure washer
- Various propane-fired fuel burning equipment already present at the facility, such as boilers, heaters, and a pellet dryer

A. APPLICABLE COUNTY REGULATIONS:

Rule 100: General Provisions and Definitions
Rule 200: Permit Requirements
Rule 220: Non-Title V Permit Provisions
Rule 280: Fees: Table A (Rendering)
Rule 314: Open Outdoor Fires
Rule 320: Odors & Gaseous Air Pollutants
Rule 323: Fuel Burning Combustion Equipment from ICI Sources
Rule 324: Stationary Internal Combustion Engines

Rule 330: Volatile Organic Compounds
Rule 331: Solvent Cleaning
Rule 353: Gasoline in Stationary Dispensing Tanks

As shown in the emission summary worksheet, Rule 241 does not apply to the the modification, per Rule 241 §102.1, since increased emissions do not exceed the minor source threshold.

Per Rule 353 §305.2, the gasoline storage tank is exempt from all requirements of Rule 353 except for cap, spills and liquid leakage provisions in §301 of that rule since the gasoline stored at the facilty is used for normal farm operations.

Per Rule 330 §307.2, Rule 330 does not apply to the protein plant even though cooking and condensing operations can result in VOC emissions, since other standards and requirements in Regulation III (namely Rule 320 §301) apply. Rule 330 does apply to all VOC-containing cleaners used in the egg plants provided they are not regulated under Rule 331.

Although organic liquid in the form of chicken fat is stored and transferred from the facility, Rules 350 and 351 only apply to bulk plants and terminals in which organic liquid are received from delivery vessels.

The new 11.544 MMBtu/hr boilers are subject to Rule 323, per §102.1 of that rule, since they are steam generating units that exceed 10 MMbtu/hr. However, the 15 MMBtu/hr dryer is not subject to Rule 323 since it does not fit any of the applicable equipment types listed in Rule 323 §102.

Rules 310 and 311 do not apply to this facility since the Permittee is following BMPs regulated by ADEQ. Under A.R.S. 49-457, agricultural activities, including poultry farms, are subject to BMPs for the control of particulate emissions.

B. APPLICABLE FEDERAL REGULATIONS:

40 CFR 60 Subpart Dc (Standards of Performance for Small Industrial/Commercial/Institutional Steam Generating Units) applies to the 11.544 MMbtu/hr boilers.

40 CFR 60 Subpart IIII (Standards of Performance for Stationary Compression Ignition ICE) applies to each diesel-fueled generator manufactured after 4/1/06.

40 CFR 63 Subpart ZZZZ (NESHAP for Stationary RICE) applies to each engine not subject to 40 CFR 60 Subpart IIII.

40 CFR 63 Subpart CCCCCC (NESHAP for Gasoline Dispensing Facilities) applies to the gasoline storage tank. Since the gasoline throughput is less than 10,000 gallons per month, only gasoline handling requirements from 40 CFR §63.11115 and 63.11116 apply. Requirements for a submerged fill pipe and a vapor balance system are reserved for larger facilities.

<u>Non-Applicable Federal Regulations</u>

40 CFR 60 Subart DD (Standards of Performance for Grain Elevators) does not apply to the facility since the grain storage and processing operations do not meet the definition of grain terminal elevator or grain storage elevator provided in 40 CFR 60.301. Grain terminal elevators do not include those located at livestock feedlots. None of the feed is meant for human consumption so dry corn milling does not meet the definition of grain storage elevator.

40 CFR 63 Subpart DDDDDDD (NESHAP for Area Sources: Prepared Feeds Manufacturing): This facilities is primarily engaged in raising/feeding chickens so it is not classified as a prepared feed manufacturing facility, per 40 CFR 63.11627. If this facility was considered a prepared feed manufacturing facility, it would most likely be subject to this Subpart since a material used in the feed contains manganese in excess of 1.0% by weight.

40 CFR 60 Subpart Kb (Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984) does not apply to either chicken fat tanks, per 40 CFR 60.110b(a), since the volumes are both less than 75 m^3 (19,813 gallons). Also, per 40 CFR 60.110b(d), the tanks are exempt from Subpart Kb since the vapor pressure of the contents is less than 15 kPa (112 mmHg). Using the fatty acid profile of chicken fat and

Antoine's equation, the true vapor pressure of liquid chicken fat heated to 160°F was calculated to be 0.002 mmHg (see calculation spreadsheet for storage tank emissions).

C. AIR POLLUTION CONTROL EQUIPMENT/EMISSION CONTROL SYSTEM(s):

System description	Quantity	Comments:
Rotory Dryer Baghouse	1	Controls particulate emissions from the rotary dryer. It is regulated by ADEQ under agricultural BMPs rather than the Control Officer.
Corn Grinder	1	The grinder is self-contained to reduce particulate emissions. It is regulated by ADEQ under agricultural BMPs rather than the Control Officer.
Feed Mixer	1	The mixer is self-contained to reduce particulate emissions. It is regulated by ADEQ under agricultural BMPs rather than the Control Officer.
Packed bed scrubber	1	Controls exhaust containing sulur compounds and VOC from various equipment in the protein plant using sodium hydroxide (NaOH). An O&M Plan is required within 60 days of permit issuance. Performance testing of total reduced sulfur and VOC is due within 90 days of permit issuance or startup of the system. Main reaction in scrubber: $H_2S + 2NaOH \rightarrow Na_2S + 2H_2O$

D. EMISSIONS:

FACILITY WIDE ALLOWABLE EMISSIONS (lbs/yr)

	Protein Plant				**Solvent Cleaning**	**Existing Facility**				**Facility-wide Total**
Pollutants	Boilers	Engine	Fat Tanks	Cookers		Engines	Fuel Burning	Gasoline Storage	Egg Cleaning	
CO:	3,750	2,608				14,927	6,000			27,285
NOx:	6,500	11,382				39,321	10,400			67,603
PM_{10}:	350	332				1,959	560			3,201
$PM_{2.5}$:	350	332				1,959	560			3,201
VOC:	400	334	0.06	1500	500	4,127	640	4,800	300	12,601
SO_X:	10	58				458	16			542

*Fuel burning equipment includes the manure dryer.

E. HAP EMISSION IMPACTS:

Based on the information provided in the permit application, the facility emits insignificant amount of HAPs; therefore, SCREEN modeling was not performed per the Department's HAPs policy.

F. PERFORMANCE TESTING:

Testing is necessary to quantify VOC emissions from the protein plant scrubber and verify that it is as effective at reducing odorous emissions (i.e.: H_2S) as an incinerator, as required by Rule 320 §301. The required efficiency was set at 85% for the scrubber. Method 16 will be used to determine the inlet and outlet concentrations of total reduced sulfur (TRS) compounds, including H_2S, dimethyl disulfide, dimethyl sulfide, and methyl mercaptan.

G. REGULATORY REQUIREMENTS AND MONITORING:

Note: Former Condition 1, requiring a permit revision before opeating the crematory, was removed since the unit is not operable. The Permittee is responsible for recognizing when a permit revision is required under Rule 220 §403.

Condition 2.b requires emissions from the protein plant cookers to be vented to the packed bed scrubber.

Condition 3.a.i requires an H_2S compliance demonstration within 90 days after startup of the protein plant.

Conditions 4-9 regulate gaseous emissions from the new protein plant. Condition 7 requires emissions from the cookers to be vented to the packed bed scrubber. Condition 9 requires a performance test for the packed bed scrubber treating the protein plant to demonstrate that H_2S emissions are reduced by 90% and to establish a VOC

emission factor for the operation. Condition 8 requires an O&M Plan for the scrubber to ensure the system operates properly.

Conditions 10-13 are based primarily on a template for fuel burning equipment less than 100 MMBtu/hr and includes requirements from NSPS Subpart Dc. Propane throughput limits are included in Permit Condition 11 to keep the facility from exceeding any applicable threshold, such as BACT, for the existing facility and new protein plant.

Conditions 14-22 are based on the current template for emergency engines subject to Rule 324, NSPS IIII and 40 CFR 63 Subpart ZZZZ. The operating limit was set at 320 hours per year to keep the facility from exceeding the BACT threshold for annual NO_X emissions of 25 tons/yr for the existing facility. The operating limit was reduced from 355 hours per year to account for existing fuel burning equipment. For simplicity, separate hour limits were not placed on the protein plant generator (G-46). Rather, all engines have the same annual operating limit but emissions from G-46 are included with the protein plant modification. To avoid circumvention issues, new engines G-45 and G-47 are included as part of the existing facility emissions since they provide power to operations already conducted at the facility (pullet and lay houses). Generators relocated to the new truck shop and transportation building were already permitted under previous revisions and are not considered part of the modification.

Conditions 23-26 regulate VOC-containing materials that are not subject to Rule 331, such as egg sanitizer.

Conditions 27-34 regulate the new parts cleaners in accordance with Rule 331.

Conditions 35-39 regulate the gasoline storage tanks and were not changed from the previous permit.

APPENDIX

040136 Emission Worksheet

Emissions Summary Worksheet

Engine hours for PTE calculation: 500

Potential Emissions (lbs/yr)

	Protein Plant				Solvent	Engines[1]		Fuel	Egg	Gasoline	
	Boilers	Engine[1]	Tanks	Cookers[2]	Cleaning	Pre NSPS	NSPS	Burning	Cleaning	Storage	Total
CO:	16,515	4,076				5,965	17,359	36,826			80,740
NO_X:	28,626	17,784				31,471	29,968	63,832			171,680
PM_{10}:	1,541	519				2,092	969	3,437			8,558
$PM_{2.5}$:	1,541	519				2,092	969	3,437			8,558
VOC:	1,762	522	0.06	9940	500	2,314	4,133	3,928	300	4,800	28,200
SO_X:	44	90				141	575	98			948

[1]Engine emissions assume 500 hours of operation.

[2]Assumes the scrubber reduces VOC emissions by 85%. PTE = allowable/(1-0.85)

Allowable Emissions (lbs/yr)

	Protein Plant				Solvent	Engines		Fuel	Egg	Gasoline	
	Boilers	Engine	Tanks	Cookers	Cleaning	Pre NSPS	NSPS	Burning	Cleaning	Storage	Total
CO:	3,750	2,608				3,817	11,110	6,000			27,285
NO_X:	6,500	11,382				20,141	19,180	10,400			67,603
PM_{10}:	350	332				1,339	620	560			3,201
$PM_{2.5}$:	350	332				1,339	620	560			3,201
VOC:	400	334	0.06	1500	500	1,481	2,645	640	300	4,800	12,601
SO_X:	10	58				90	368	16			542

BACT Threshold Evaluation

	Protein Plant & Solvent Cleaning	Existing Facility	BACT Limits	Is BACT Exceeded?
CO:	6,358 lbs/yr	20,927 lbs/yr	200,000 lbs/yr	no
NO_X:	17,882 lbs/yr	49,721 lbs/yr	50,000 lbs/yr	no
PM_{10}:	682 lbs/yr	2,519 lbs/yr	40,000 lbs/yr	no
$PM_{2.5}$:	682 lbs/yr	2,519 lbs/yr	20,000 lbs/yr	no
VOC:	2,734 lbs/yr	9,867 lbs/yr	50,000 lbs/yr	no
SO_X:	68 lbs/yr	474 lbs/yr	50,000 lbs/yr	no

Minor New Source Review (NSR) Applicability

	Previous Limits	New Limits	Change	Minor NSR Mod. Threshold	Above threshold
CO:	25,212 lbs/yr	27,285 lbs/yr	2,073 lbs/yr	100,000 lbs/yr	no
NO_X:	49,869 lbs/yr	67,603 lbs/yr	17,734 lbs/yr	40,000 lbs/yr	no
PM_{10}:	3,005 lbs/yr	3,201 lbs/yr	196 lbs/yr	15,000 lbs/yr	no
$PM_{2.5}$:	3,005 lbs/yr	3,201 lbs/yr	196 lbs/yr	10,000 lbs/yr	no
VOC:	11,219 lbs/yr	12,601 lbs/yr	1,382 lbs/yr	40,000 lbs/yr	no
SO_2:	470 lbs/yr	542 lbs/yr	72 lbs/yr	50,000 lbs/yr	no

Emission Worksheet for Diesel Engines Not Subject to NSPS IIII (Pre-NSPS Engines)

320 annual hours of operation

Engines **Protein Plant Engine**

I.D. #	Power (HP)	I.D. #	Power (HP)	I.D. #	Power (HP)	I.D. #	Power (HP)
G-2	380	G-7	380	G-8	11	G-46	1,482
G-4	380	G-9	380				
G-5	380						
G-6	380						
TOTAL	1,520		760		11		

Emission factors

Emission factors for the two newest engines, G-7 and G-9 are based on exhaust emission data for Cummins generator model 230DFAB powered by a cummins LTA10-G1 engine. The remaining diesel engine emissions were obtained from AP-42 Table 3.3-1 for engines rated 600 HP and less and AP-42 Table 3.4-1 for engines greater than 600 HP.

I.D. #	G-2, G-4, G-5, G-6	G-7, G-9	G-8 (propane)	G-46
EF Source:	AP-42 Table 3.3-1	Cummins Data Sheet	ADEQ*	AP-42 Table 3.4-1
CO:	0.0067 lbs/hp-hr	400 g/hr	8.26E-04 lb/hp-hr	0.0055 lbs/hp-hr
NO_X:	0.0310 lbs/hp-hr	3534 g/hr	2.22E-02 lb/hp-hr	0.024 lbs/hp-hr
PM_{10}:	0.0022 lbs/hp-hr	190 g/hr	5.40E-07 lb/hp-hr	0.0007 lbs/hp-hr
$PM_{2.5}$:	0.0022 lbs/hp-hr	190 g/hr	5.40E-07 lb/hp-hr	0.0007 lbs/hp-hr
VOC:	0.0025 lbs/hp-hr	182 g/hr	8.26E-04 lb/hp-hr	7.05E-04 lbs/hp-hr
SO_X:	see below	see below	4.10E-06 lb/hp-hr	see below

*ADEQ Annual Air Emissions Questionnaire Emission Factors (2014) , Form 2.1

SO_x Emissions (AP-42 Table 3.4-1)

The SOX factor for all diesel engines is taken from AP-42 Table 3.4-1 since that factor is based on a mass balance that assumes all fuel sulfur is oxidized to SO2. The SOX factor in Table 3.3-1 is not based on the fuel sulfur content and therefore is not appropriate to use since the permit includes diesel fuel sulfur limits.

	Emission Factor	0.015% S, allowable sulfur content in fuel
SO_X:	0.0001 lbs/hp-hr	$SO_X = 0.00809(S)$ AP-42 Table 3.4-1

Emissions

Engine:	G-2, G-4, G-5, G-6	G-7, G-9	G-8	G-46, Protein Plant
CO:	**3,250 lbs/yr**	**565 lbs/yr**	**3 lbs/yr**	**2,608 lbs/yr**
NO_X:	**15,079 lbs/yr**	**4,986 lbs/yr**	**76 lbs/yr**	**11,382 lbs/yr**
PM_{10}:	**1,071 lbs/yr**	**268 lbs/yr**	**0 lbs/yr**	**332 lbs/yr**
$PM_{2.5}$:	**1,071 lbs/yr**	**268 lbs/yr**	**0 lbs/yr**	**332 lbs/yr**
VOC:	**1,221 lbs/yr**	**257 lbs/yr**	**3 lbs/yr**	**334 lbs/yr**
SO_X:	**60 lbs/yr**	**30 lbs/yr**	**0 lbs/yr**	**58 lbs/yr**

Emission Worksheet for NSPS IIII Diesel Engines

320 annual hours of operation

1 KW= 1.341 HP

40 CFR 89 Non-Road Diesel Engine Standards

Rated Power	Emission Standard	Emission Factors (g/kw-hr) CO	NMHC + NOx	PM	HC
130≤kW<560	Tier 3	3.5	4	0.2	1.3

Exhaust Emission Data for Generator Sets

Gen Model:	Cummins 350DFEG	Cummins 200DSHAC	Cummins 250DQDAA	Cummins 125DSGAB
NOx:	2262 g/hr	1089 g/hr	1306 g/hr	469 g/hr
CO:	281 g/hr	214 g/hr	607 g/hr	164 g/hr
PM:	26 g/hr	16 g/hr	31 g/hr	17 g/hr
VOC:	35 g/hr	16 g/hr	32 g/hr	35.4 g/hr

SO_X Emissions (AP-42 Table 3.4-1)

	Emission Factor	0.015% S, allowable sulfur content in fuel
SO_X:	0.0001 lbs/hp-hr	$SO_X = 0.00809(S)$ AP-42 Table 3.4-1

Emissions

Except as noted, CO, NOx and PM10 emission factors are set at the Tier 3 emission standards for non-road diesel engines specified in 40 CFR 89.112. VOC emissions are set at the Tier 1 limit since Tier 3 standards consist of NOx plus non-methane hydrocarbons rather than VOC alone. The SO_X factor for all engines is taken from AP-42 Table 3.4-1 since the factor is based on a mass balance that assumes all fuel sulfur is oxidized to SO_2. The SO_X factor in Table 3.3-1 is not based on the fuel sulfur content and therefore is not appropriate to use since the engines are required to burn ultra low sulfur diesel.

I.D. #	Generator Model	Power (HP)	Engine Year	Emission Standard	Emissions (lbs/yr) CO	NO_X	PM_{10}	VOC	SO_X
G-1*	Cummins 350DFEG	755	2010	Tier 2	198	1,596	18	24	29
G-10*	Cummins 200DSHAC	310	2007	Tier 3	151	768	11	12	12
G-11*	Cummins 250DQDAA	464	2007	Tier 3	428	922	22	22	18
G-12	Katolight SED350FRX4T3	685	2007	Tier 3	1,261	1,441	72	468	27
G-13	Katolight SED250FRJ4T3	422	2008	Tier 3	777	888	44	289	16
G-14	Katolight SED250FRJ4T3	422	2008	Tier 3	777	888	44	289	16
G-15	Katolight SED150FRJ4T3	237	2008	Tier 3	436	499	25	162	9
G-16	Katolight SD150RJ6T3	422	2008	Tier 3	777	888	44	289	16
G-17	MTU Onsite Energy 250-JS6DT3	422	2010	Tier 3	777	888	44	289	16
G-18	MTU Onsite Energy 250-JS6DT3	422	2010	Tier 3	777	888	44	289	16
G-19	MTU Onsite Energy 250-JS6DT3	422	2010	Tier 3	777	888	44	289	16
G-20*	Cummins 250DQDAA	464	2012	Tier 3	428	922	22	22	18
G-21*	Cummins 250DQDAA	464	2012	Tier 3	428	922	22	22	18
G-22*	Cummins 250DQDAA	464	2012	Tier 3	428	922	22	22	18
G-23*	Cummins 250DQDAA	464	2013	Tier 3	428	922	22	22	18
G-24*	Cummins 250DQDAA	464	2013	Tier 3	428	922	22	22	18
G-25*	Cummins 250DQDAA	464	2013	Tier 3	428	922	22	22	18
G-39*	Cummins 250DQDAA	464	2015	Tier 3	428	922	22	22	18
G-45*	Cummins 250DQDAA	464	2015	Tier 3	428	922	22	22	18
G-47*	Cummins 250DQDAA	464	2015	Tier 3	428	922	22	22	18
FM1*	Cummins 125DSGAB	324	2012	Tier 3	116	331	12	25	13
Total:		9483			11,110	19,180	620	2,645	368

*Emission rates for CO, NOx, VOC and PM10 are based on the engine manufacturer's specification sheet for the specific generator set.

Propane-Fueled Equipment Emissions

Input rating of equipment

	Existing Equipment		Protein Plant Equipment	
	19.50	MM Btu/hr (78 x 250,000 BTU/hr heaters)	11.50	MM Btu/hr boiler
	15.00	MM Btu/hr dryer	11.50	MM Btu/hr boiler
	0.74	MM Btu/hr pressure washer	**23.00**	**MM Btu/hr Total**
	1.46	MM Btu/hr boiler		
	2.10	MM Btu/hr boiler		
	4.00	MM Btu/hr boiler		
	4.00	MM Btu/hr dryer		
	1.26	MM Btu/hr boiler		
	1.26	MM Btu/hr boiler		
	0.99	MM Btu/hr boiler		
	0.99	MM Btu/hr boiler		
Total	**51.29**	**MM Btu/hr**		

Emission factors (AP-42 Table 1.5-1)

CO:	7.5	lb/1000 gal
NOx:	13	lb/1000 gal
PM10:	0.7	lb/1000 gal
PM2.5:	0.7	lb/1000 gal
VOC:	0.8	lb/1000 gal
SOx	0.02	lb/1000 gal (Emissions Inventory)

Constants

91,500 btu/gal propane energy content (AP-42 Sect. 1.5-1)

	Existing Facility	Protein Plant
	24 hrs/day	24 hrs/day
	365 days/yr	365 days/yr

Potential Emissions (assumes all equipment operates 24 hrs/yr, 365 days/yr at full capacity):

	Existing Equipment	Protein Plant	Total
CO:	36,826 lbs/yr	16,515 lbs/yr	53,341 lbs/yr
NOx:	63,832 lbs/yr	28,626 lbs/yr	92,457 lbs/yr
PM10:	3,437 lbs/yr	1,541 lbs/yr	4,978 lbs/yr
PM2.5:	3,437 lbs/yr	1,541 lbs/yr	4,978 lbs/yr
VOC:	3,928 lbs/yr	1,762 lbs/yr	5,690 lbs/yr
SOx	98 lbs/yr	44 lbs/yr	142 lbs/yr
Propane Equivalent	4,910,127 gals/yr	2,201,967 gals/yr	7,112,094 gals/yr

Allowable Emissions based on propane usage limits:

Propane Limts

Existing Equipment:	800,000 gals/yr
Protein Plant:	500,000 gals/yr

	Existing	Protein Plant	Total
CO:	6,000 lbs/yr	3,750 lbs/yr	9,750 lbs/yr
NOx:	10,400 lbs/yr	6,500 lbs/yr	16,900 lbs/yr
PM10:	560 lbs/yr	350 lbs/yr	910 lbs/yr
PM2.5:	560 lbs/yr	350 lbs/yr	910 lbs/yr
VOC:	640 lbs/yr	400 lbs/yr	1,040 lbs/yr
SOx	16 lbs/yr	10 lbs/yr	26 lbs/yr

Egg Cleaning Agent Emissions:

Material	Usage	Density	VOC Content	VOC Emissions
Sano Quat 4100	657 gals/yr	8.4 lbs/gal	1.50%	83 lbs/yr

Solvent Cleaning Emissions Calculation Worksheet

VOC Emissions:

VOC emissions from solvent cleaning materials are calculated by multiplying the estimated usage per year (less waste disposal) by the VOC content of the material. These numbers are then summed to produce an aggregate amount of VOCs emitted from the cleaning machines.

Material	Usage [gal/yr]	Waste[1] [gal/yr]	lbs/gal.[2]	lbs/year	lbs VOC/gal.	lbs VOC/year
627 Solvent	260	234	6.91	179.57	6.91	180
				0.00		0
Total VOC:						**180**

[1]The application indicates that 100% of the solvent will be disposed as waste. This calculation sheet assumes that 90% is disposed as waste and the remaining 10% evaporates on site.

[2]The MSDS for 627 solvent did not specify the density so the value used in this calculation is based on the highest density of the main components (petroleum distillates, CAS No. 64742-47-8).

Hazardous Air Pollutants (HAPs)

HAP emissions from solvents are calculated by multiplying the estimated usage per year (less waste disposal) by the concentration of each HAP in the solvents. These numbers are then summed to produce an aggregate amount of HAPs emitted from the solvent cleaning operations.

Material	HAP	lbs/year	% HAPs	lb HAP/year
627 Solvent	benzene	180	0.0001%	0.00018
627 Solvent	toluene	180	0.0099%	0.01778
627 Solvent	ethylbenzene	180	0.0001%	0.00018
627 Solvent	naphthalene	180	0.0001%	0.00018
Total HAPs:				**0.02**

Gasoline Storage Tanks Worksheet:

Maximum throughput: 120,000 gallons/year

Aboveground Tank VOC Emission Rate: **40 lbs/1000 gal** (Emissions Inventory Instruction Sheet)

VOC Emissions:	**4,800 lbs VOC/year**

Scrubber Outlet VOC

The VOC Emission factor for the protein plant cookers was obtained from a North Carolina DAQ test conducted at a poultry rendering plant using a packed bed scrubber. This value will be used until site-specific VOC factor is obtained from performance test results.

https://ncdenr.s3.amazonaws.com/s3fs-public/Air%20Quality/inventory/industry/render/renderletter_0800.pdf

VOC emissions factor:	0.0994	lbs/ton
Expected throughput to plant:	7,500	tons/yr
Allowable throughput:	10,000	tons/yr
VOC emissions:	994	lbs/yr

Allowable VOC Emissions: **1,491** **lbs/yr** (includes a 50% safety factor)

Vapor Pressure Determination for Chicken Fat at 160°F

This exercise is used to estimate the actual vapor pressure, moledular weight, and RVP of heated chicken fat. Antoine's equation was used to calculate the vapor pressure of each fatty acid contained in chicken fat, then Raoult's law was used to calculate the total pressure of the solution by summing the partial pressure of each component.

Antoine's Equation: $\log(P_v) = A-B/(T+C)$ where P is in mmHg and T is in Celsius

Where: P_v is the vapor pressure of a pure liquid at temperature T in mmHg

A, B and C are Antoine's equation constants (chemical dependent)

T (°C) = 71.1

Raoult's Law: $P_{Vmix} = \Sigma P_{vi} X_i$

P_{Vmix} is the total vapor pressure of the chicken fat mixture

P_v is the vapor pressure of the pure liquid at temperature T

X_i is the molar content of each fatty acid in the mixture (weight percent x molecular weight)

Fatty Acid Composition of Chicken Fat[1]							Antoine's Eqn Constants[2]			P_v	$P_{vi}X_i$
Constituent	Formula	Acid Symbol	Molecular Weight	Weight Fraction	Molar Fraction, X_i		A	B	C	(mmHg)	(mmHg)
Myristic acid[2]	$C_{14}H_{28}O_2$	C14:0	228.37	0.6%	1.37	0.7%	7.91297	2450.62	160.791	0.002	0.000
Palmitic acid[2]	$C_{16}H_{32}O_2$	C16:0	256.42	22.8%	58.46	24.3%	8.58266	3341.95	235.116	0.005	0.001
Palmitoleic acid[3]	$C_{16}H_{30}O_2$	C16:1	254.41	8.4%	21.37	9.0%	8.58266	3341.95	235.116	0.005	0.000
Stearic acid[2,4]	$C_{18}H_{36}O_2$	C18:0	284.48	5.4%	15.36	5.2%	7.86912	2572.31	140.468	0.000	0.000
Oleic acid[2]	$C_{18}H_{34}O_2$	C18:1	282.46	42.1%	118.92	40.7%	8.0641	2729.09	166.667	0.000	0.000
Linoleic acid[2]	$C_{18}H_{32}O_2$	C18:2	280.45	17.1%	47.96	16.7%	8.138	2780.12	173.974	0.001	0.000
Linolenic acid[3]	$C_{18}H_{30}O_2$	C18:3	278.43	1.1%	3.06	1.1%	8.58266	3341.95	235.116	0.005	0.000
Gadoleic[3]	$C_{20}H_{38}O_2$	C20:1	310.52	0.5%	1.55	0.4%	8.58266	3341.95	235.116	0.005	0.000
Other[3]			256.42	2.0%	5.13	2.1%	8.58266	3341.95	235.116	0.005	0.000
Totals:				100.0%	273.18					**Total Fat Vapor Pressure at 71° C:**	**0.002**

[1]A Demonstration of Fat and Grease as an Industrial Boiler Fuel, 2002, University of G http://www.biorefinery.uga.edu/docs/biofuel_oil_report.pdf

[2]Source: Antoine Coefficient (°C Temperature) Nov 17, 2013 by harrison_s https://www.scribd.com/doc/184780110/Antoine-Coefficient-C-Temperature

[3]Antoine's equation constants were not available for an appropriate temperature range so they were set at the values for C16:0 since it has the greatest

[4]Actual tank temperature (71°C) is below the minimum temperature for the parameters used for stearic acid (177°C) .

Standing Storage and Working Loss Emissions for Vertical Aboveground Tanks with Fixed Roofs

Adapted from AP-42 Section 7.1.3.1 (Total Losses From Fixed Roof Tanks)

111,790		Annual Fat Throughput per Tank (gallons)
2,662	Q	annual net throughput, bbl/yr 1 bbl = 42 gallons

Tank Dimensions:

8.0	D	tank diameter, ft
18.0	H_{LX}	maximum liquid height, ft
20.0	H	Height, ft
2.0	H_{VO}	vapor space outage, ft (for flat roof)

Tank Paint Solar Absorptance Tank color = white

0.17	α	tank paint solar absorptance, dimensionless (AP-42 Table 7.1-6)

Liquid Properties (derived from Antoine's Eqn & Raoult's Law to right)

1.6E-06	RVP	Reid vapor pressure, psi (calculated VP at 100°F)
273.18	M_V	vapor molecular weight, lb/lb-mole
3.9E-05	P_{VA}	vapor pressure at daily average liquid surface temp, psia
1	S	Distillation slope at 10% volume, (°F/vol%); (AP-42 Table 7.1-4)

Meterological Data for Phoenix, AZ (from AP-42 Table 7.1-7)

1,869	I	daily total solar insolation on a horizontal surface, Btu/(ft^2 day)
545.1	T_{AX}	daily maximum ambient temperature, °R
517.3	T_{AN}	daily minimum ambient temperature,°R

0.03	P_{BP}	breather vent pressure setting range, psig; assume 0.03 psig
-0.03	P_{BV}	breather vent vacuum setting, psig; assume -0.03 psig
1	K_P	working loss product factor (0.75 for crude oil, 1 for other organic liquids)
531.2	T_{AA}	daily average ambient temperature, °R; = (T_{AX}+T_{AN}) / 2
27.8	ΔT_A	daily ambient temperature range, °R; = T_{AX}-T_{AN}
531.2	T_B	liquid bulk temperature, °R; = T_{AA} + 6*α - 1
533.7	T_{LA}	daily average liquid surface temperature, °R; = 0.44 T_{AA} + 0.56*T_B+0.0079 α* I
28.9	ΔTv	daily vapor temperature range, °R; = 0.72 * ΔT_A + 0.028 α*I
0.052	K_E	vapor space expansion factor; = 0.0018 [0.72 (T_{AX} - T_{AN}) + 0.028 αI] for true VP <0.1psia
0.000	ΔP_V	daily vapor pressure range, psi; = 0.50*B*P_{VA}*ΔT_V/(T_{LA}^2)
0.06	ΔP_B	breather vent pressure setting range, psi; = P_{BP} - P_{BV}
14.7	P_A	atmospheric pressure, psia
23028	B	vapor pressure constant = 8742 - 1072*$S^{0.5}$ ln (RVP)
1.000	K_S	vented vapor saturation factor, dimensionless; = 1 / (1 + 0.053 *P_{VA} *H_{VO})
0.000	W_V	stock vapor density, lb/ft^3; = (M_V * P_{VA})/(R * T_{LA})
10.371	R	the ideal gas constant,psia ft^3/lb-mole °R
904.78	V_{LX}	tank maximum liquid volume, ft^3; = (π/4)*D^2 * H_{LX}
16.52	N	number of turnovers per year, dimensionless; = (5.614*Q)/V_{LX}
1.00	K_N	working loss turnover factor; for turnovers > 36, KN = (180 + N)/ 6N; for turnovers ≤ 36, KN = 1

Standing Storage Losses, L_S	L_S = 365 * K_E* (π/4)*D^2 *H_{VO}*K_S* W_V =	0.004 lb/yr
Working Losses, L_W	L_W = 0.0010 M_V * P_{VA}* Q * K_N * K_P =	0.03 lb/yr
Total Losses, L_T	L_T = L_S + L_W =	0.03 lb/yr
Total Losses for two Tanks:		**0.06 lb/yr**

Maricopa County
Air Quality Department

NON-TITLE V
COMPLETENESS DETERMINATION CHECKLIST

Items 1-15 Front page: Items 1 to 15 (14 for Renewals) must be completed.

Notes to engineer:

- *For renewal applications the source must either answer 'No' to questions 2-5 or submit an application for a permit modification.*
- *Item 8: Many applicants do not know the SIC code or NAICS code for their industry. For a new application the code can be obtained by doing an on-line search. http://www.osha.gov/pls/imis/sicsearch.html*
- *Items 5, 7 and 14: These may be the same for many applicants.*

Complete: [x] Incomplete: [ ]

Item 16: A simple site diagram has been included, preferably on a standard size paper. Detailed blueprints or construction drawings are not required.

Complete: [x] Incomplete: [ ] N/A: [ ]

Item 17: A simple process flow diagram on a standard size paper is preferred. A process flow diagram may not be needed for some small businesses.

Complete: [x] Incomplete: [ ] N/A: [ ]

Item 18: An O&M plan is required only for a control device. An O&M plan is not required for a spray booth. Instead of including the O&M plan with the application, an applicant may submit it after receiving the permit.

Note: A scrubber operating manural was provided. Complete: [ ] Incomplete: [x] N/A: [ ]

Item 19: A dust control plan, if required, must accompany the permit application. The plan will be reviewed and approved by the dust compliance group.

Complete: [ ] Incomplete: [ ] N/A: [x]

Item 20: The applicant needs to complete only those sections of the permit application that are applicable.

Complete: [x] Incomplete: [ ] N/A: [ ]

Notes to engineer:

- *Concerning Section Z: Many applicants will not be able to perform these engineering calculations. We will accept the permit application with a blank Section Z.*

Instructions for completing Sections A, B, C, D, E-1, E-2, F, G, H, I, J, K-1, K-2, K-3, K-4, L, M, X-1, X-2, Y and Z of the permit application are included at the beginning of each section and are self-explanatory.

In general, a material safety data sheet (MSDS) is required for each chemical used, stored or processed at the facility. Exceptions are for very common materials, such as gasoline, diesel, acetone, etc.

Business name: **Hickman's Egg Ranch**

Permit number: **040136**

Completeness review completed.
Application determined to be: Complete: [x] Incomplete: [ ]

Permit Engineer: **Sara Seuberling** Date: **05/06/2016**